

M. D. Hubbard Spring
Company

PONTIAC, MICHIGAN



AUGUST 1923

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Decimal Equivalents

1/64	.015625	33/64	.515625
1/32	.03125	17/32	.53125
1 Millimeter	.03937	35/64	.546875
3/64	.046875	9/16	.5625
1/16	.0625	37/64	.578125
5/64	.078125	19/32	.59375
3/32	.09375	39/64	.609375
7/64	.109375	5/8	.625
1/8	.125	41/64	.640625
9/64	.140625	21/32	.65625
5/32	.15625	43/64	.671875
11/64	.171875	11/16	.6875
3/16	.1875	45/64	.703125
13/64	.203125	23/32	.71875
7/32	.21875	47/64	.734375
15/64	.234375	3/4	.75
1/4	.25	49/64	.765625
17/64	.265625	25/32	.78125
9/32	.28125	51/64	.796875
19/64	.296875	13/16	.8125
5/16	.3125	53/64	.828125
21/64	.328125	27/32	.84375
11/32	.34375	55/64	.859375
23/64	.359375	7/8	.875
3/8	.375	57/64	.890625
25/64	.390625	29/32	.90625
13/32	.40625	59/64	.921875
27/64	.421875	15/16	.9375
7/16	.4375	61/64	.953125
29/64	.453125	31/32	.96875
15/32	.46875	63/64	.984375
31/64	.484375	1	1.
1/2	.5		

ESTABLISHED 1905

M. D. HUBBARD SPRING CO.

636 SOUTH JESSIE STREET

(Near South Saginaw Street Car Line)

Pontiac - Michigan

*Visitors to our works, arriving on
Interurban cars, from Detroit,
should leave cars at South Boule-
vard, Pontiac.*



PLUG READY TO EXPAND

COILED AND FLAT SPRINGS

(Phosphor Bronze Springs a Specialty)

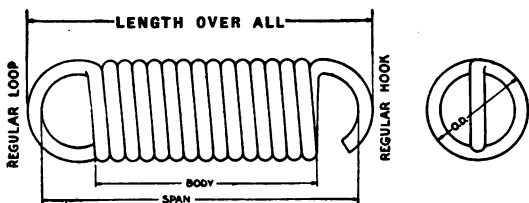
COTTERS, SMALL WASHERS

WELCH PATENT EXPANSION PLUGS

WIRE SHAPES, SPECIAL STAMPINGS

GATE HINGES, Etc.

Forms for Describing Springs



Regular Extension Springs

Quantity.....Size of Wire.....

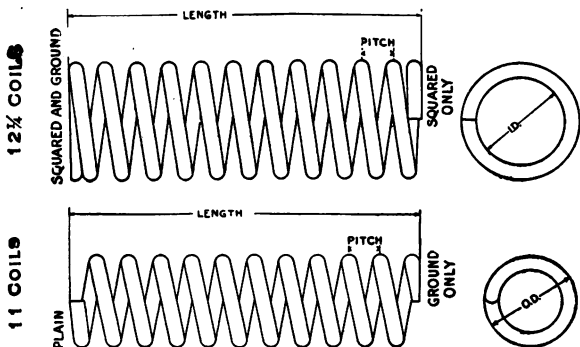
Outer Diameter.....

Length of Body.....
(If length is measured over all or span, state that fact)

Hooks or Loops.....

Japanned or Plain.....

Distance Extended.....Load in lbs.....



Regular Compression Springs

Quantity.....Size of Wire.....

Diameter.....Length.....
(State whether outer or inner dimensions.)

Number of Coils.....Japanned?.....

Ends—Place an "X" opposite one of the four ends
of above springs to indicate style of ends wanted.

Distance Compressed.....Load in lbs.....

If springs work over a rod, specify diameter of rod.
If they work in a hole, specify size of hole.

Name.....

Address.....

Order or Enquiry.....

This page is for your convenience in describing springs. If you wish to use it, cut on dotted line, fill in required information and return slip to us.

Kinds of Wire and Finishes

- 1 Springs for ordinary work are generally made from steel wire and black japanned.

Weights, etc., page 32.

Design capacities, page 8.

See foot note on page 8 for remarks regarding heat treating of springs.

- 3 Phosphor Bronze and Brass Springs are commonly used where work is exposed to moisture, acids or other corrosive elements. These materials have less strength and a shorter working range of safe compression and extension than tempered steel springs made from wire of equal size, but for service to which they are peculiarly adapted, by reason of their non-rusting quality, Phosphor Bronze Springs are very popular and we make a specialty of springs of this material.

Phosphor Bronze and Brass Springs are seldom japanned.

Weights, gauges, etc., page 33.

- 5 Music Wire, also termed "Piano Wire," is generally used when a finer wire than No. 21 (.032") is required and is also used to a limited extent for heavier springs. Springs made from this class of wire have bright surface unless japanned or specially treated to produce temper colors.

Table of sizes and weights, page 34

Terms

- 7 Regular accounts 30 days net or 2% off for cash within ten days from date of invoice.
- 9 Experimental and other special work cash deposit with order as provided in paragraph 27, page 5.
- 11 Terms for special tools, cash in advance regardless of customer's rating. Special tools are not subject to removal as we only charge customer with a part of their cost and it is very seldom that tools made for the machines and methods of one spring-maker can be used to advantage by another.

Terms (continued)

13 Quotations are for prompt acceptance only and prices are subject to future change notices, as circumstances may require.

15 Prices quoted upon a specified quantity of springs will not apply to smaller lots, as the quantity to be made is an important cost factor.

17 If prices are based upon installment deliveries, we usually coil the entire quantity at one time, tempering and finishing in such quantities and at such times as may be necessary, or to our convenience. Therefore, in asking for prices, buyers should only specify such quantities as they are willing to authorize us to make in one run.

19 Cancellations of orders that have been started by us cannot be accepted otherwise than on a basis of buyer paying all expense that has been incurred to date.

21 We aim to carefully inspect all goods before shipment and reject all product that is not O. K. in every respect. Should any of our springs prove defective, or not of dimensions ordered, we will replace them, if returned, accompanied by an order to replace.

In this connection see page 7 regarding normal variations for which buyers must make allowance.

23 When practicable, send blueprint or sample of assembly in which springs are used. If this is not done, state space limitations and working range of springs.

25 As all working conditions and requirements are not usually stated, it is not our custom to pass judgment upon the suitability of proposed designs, nor can we guarantee results. On all accepted orders we follow instructions carefully, after which the try-out must be at customer's cost and risk. On the other hand, if, in our judgment, a design is clearly impracticable or if there is an easier and less expensive way, we usually state our view of the case (in customer's interest) and await instructions, before proceeding. We prefer to forego business rather than furnish springs that we feel sure will prove unsatisfactory, by reason of the buyer having over-estimated their service possibilities.

Samples, Etc.

27 Sample springs made to order will be charged on time and material basis which will be estimated in advance (if desired) upon receipt of specifications. If ordered by other than regular customers or established houses a deposit of the estimated cost must accompany the order.

29 Conditions permitting, we sometimes set up a job, make samples, and hold machine idle pending reply. In such cases, report by wire is desired.

31 As nearly the whole cost of small lots of springs made to order is incidental to the necessary set-up and adjustment of machines prior to production, it is generally the case that a hundred springs cost but little more than a dozen, or even a single sample, therefore, order should be sufficient for all test requirements and, on a chance of the design proving acceptable, a few to use while quantity lot is being made up. It is cheaper to do this and throw away the surplus, if not wanted, than to set up for two small runs.

33 We have springs of various designs on hand and when desired can sometimes furnish samples approximating the required design, which will be helpful for preliminary experimenting and determining just what is needed. These on-hand samples will be furnished for a nominal charge which will be refunded if quantity orders are placed.

See description of Spring Assortments page 39.

Wire Gauges

35 Several different systems or standards of measurement have been introduced by wire manufacturers from time to time, and by confusing these several gauges buyers have been put to considerable trouble and inconvenience. It is, therefore, very important to state the gauge used as the basis of measurement and it is also desirable to state the decimal equivalent of the gauge, as shown by micrometer measurement, or as shown by tables, pages 28-34.

Gauges Regularly Used On Spring Materials

37 The **Washburn & Moen Gauge**, also called "Steel Wire Gauge," by the American Steel & Wire Company, is the system commonly used in specifying iron and steel wire sizes. For weights, etc., see page 32.

39 The **Birmingham Wire Gauge**, also termed "Stubs," "English Standard" and "Stubs Iron Wire Gauge," is occasionally used for designating wire sizes. Its principal use is to designate the thickness of flat steel.

41 The **Brown & Sharpe Gauge**, otherwise known as "American Wire Gauge," (not American Steel & Wire Company's Gauge), is standard for Phosphor Bronze, Brass and Copper wires. (Brown & Sharpe gauges of steel wire are occasionally used when desired results cannot be obtained without using a size intermediate between two Washburn & Moen sizes).

43 Music or piano wire (described in paragraph 5, page 3), has a distinctive gauge of its own. See page 34 for table of decimal equivalents.

45 As a general rule, wire is carried in stock only in the standards above outlined for the different materials.

Gauges Not Commonly Used on Spring Materials

47 U. S. Standard gauge equivalents will be found on page 31. This gauge is similar to W. & M. gauge modified to conform or agree more closely with common fraction sizes. See pages 28-30 for comparisons.

49 Stubs Steel Wire Gauge differs radically from Stubs Iron Wire Gauge described in paragraph 39. Decimal equivalents will be found in center column on page 31. It is standard for drill rods and very seldom used for any other material.

51 Some establishments use the French or Metric System of measurements. The decimal equivalent of the millimeter is .03937". (See page 31, 7th column.)

53 In the tables on pages 28-30 we have arranged the above gauges in progressive order of the decimal equivalents of the several sizes.

Variations

61 Coiled springs are subject to slight variations in dimensions incidental to heat treatment and other causes and allowance for such variations in diameter and length should be made by the buyer.

After stating the diameter of the required spring, engineers generally state that it may be "plus-minus $1/32$," or such other limit of variation above and below the indicated size as can be consistently allowed.

63 Another form of stating diameter limits is, for example, "not less than $25/32$ inner diameter and not more than $29/32$ outer diameter." This would lead us to infer that the spring was to work over a $3/4$ " rod and in a $15/16$ hole.

65 Please state diameters of the rods or stems over which, and the diameters of holes in which springs are to work.

67 If a spring is ordered to carry a specified load at a given height or length, a suitable variation allowance should be made in the number of pounds to be carried, say 10 % more or less than the specified load.

69 If the variation allowance is less than 8 % an advanced price will apply, if order is taken at all.

A competitor states the matter as follows:

"In spring-making, natural variations will occur, namely, in diameter of coil, pitch and number of coils of open wound springs and pounds resistance under given motion, when extended or compressed. For all of this, customers when placing orders must provide, as the manufacturer will not be responsible for same."

Flat Springs, Bent Wires, etc., are subject to similar tolerances. It is desirable that sample or blue print of assembly accompany orders so that spring makers can see just what is expected of the design.

COILED STEEL SPRINGS

Safe Loads, etc.

Size of Wire Ins.	Stiff Springs			Normal Springs			Soft Springs		
	Outer Diam. Ins.	Safe Load Lbs.	De-flect per Coil Ins.	Outer Diam. Ins.	Safe Load Lbs.	De-flect per Coil Ins.	Outer Diam. Ins.	Safe Load Lbs.	De-flect per Coil Ins.
			*			*			*
.028							$\frac{1}{16}$	2.0	.04
.032				$\frac{1}{8}$	3.4	.024	$\frac{1}{8}$	2.7	.043
.035				$\frac{1}{8}$	4.1	.029	$\frac{3}{16}$	3.0	.057
.041	$\frac{1}{4}$	7.6	.018	$\frac{1}{8}$	5.8	.030	$\frac{1}{8}$	4.0	.065
.047	$\frac{1}{8}$	10.4	.020	$\frac{3}{8}$	7.5	.040	$\frac{1}{2}$	5.4	.076
.054	$\frac{1}{8}$	14.3	.021	$\frac{1}{8}$	9.7	.047	$\frac{1}{8}$	7.3	.083
.063	$\frac{3}{8}$	19.0	.0266	$\frac{1}{2}$	13.0	.051	$\frac{5}{8}$	10.5	.087
.072	$\frac{1}{8}$	24.0	.031	$\frac{1}{8}$	18.0	.060	$\frac{3}{4}$	13.0	.118
.083	$\frac{1}{2}$	32.0	.036	$\frac{1}{2}$	22.0	.076	$\frac{1}{2}$	18.0	.109
.091	$\frac{1}{8}$	37.0	.032	$\frac{3}{4}$	26.0	.084	$\frac{1}{2}$	21.0	.138
.095	$\frac{1}{8}$	43.0	.040	$\frac{3}{4}$	31.0	.080	$\frac{1}{2}$	24.0	.130
.102	$\frac{5}{8}$	48.0	.047	$\frac{1}{2}$	35.0	.086	1	28.0	.159
.105	$\frac{5}{8}$	52.0	.045	$\frac{7}{8}$	35.0	.097	1	30.0	.131
.109	$\frac{1}{2}$	52.0	.053	$\frac{7}{8}$	40.0	.094	$1\frac{1}{8}$	30.0	.165
.120	$\frac{3}{4}$	65.0	.058	1	46.0	.112	$1\frac{1}{4}$	36.0	.185
.128	$\frac{3}{4}$	79.0	.052	1	57.0	.104	$1\frac{1}{4}$	44.0	.171
.134	$\frac{1}{2}$	80.0	.061	$1\frac{1}{8}$	55.0	.1	$1\frac{3}{8}$	43.0	.200
.148	$\frac{7}{8}$	105.0	.062	$1\frac{1}{4}$	69.0	.113	$1\frac{1}{2}$	56.0	.214
.162	1	120.0	.076	$1\frac{3}{8}$	83.0	.159	$1\frac{5}{8}$	68.0	.229
.177	$1\frac{1}{8}$	144.0	.092	$1\frac{3}{8}$	114.0	.148	$1\frac{3}{4}$	87.0	.258
.192	$1\frac{1}{8}$	179.0	.079	$1\frac{1}{2}$	127.0	.155	2	92.0	.296
.203	$1\frac{1}{4}$	188.0	.094	$1\frac{5}{8}$	139.0	.174	$2\frac{1}{8}$	102.0	.316
.225	$1\frac{3}{8}$	230.0	.101	$1\frac{3}{4}$	176.0	.180	$2\frac{1}{4}$	132.0	.317
.250	$1\frac{1}{2}$	295.0	.109	2	210.0	.212	$2\frac{1}{2}$	164.0	.354

*Deflection per Coil under indicated safe Load.

Modulus of Elasticity, 10,800,000; Fibre Stress, 60,000 lbs.

The above classifications "stiff," "normal" and "soft" as applied to compression springs of stated diameters and wires, refer to springs having a pitch about three times size of wire.

Dimensions of Springs determine their capacity. The idea, occasionally encountered, that the work a spring will do can be considerably increased by a change in its temper is not correct.

Proper tempering merely enables the spring to do its work safely and continuously within the limits of its normal capacity.

Notes on Designs, Etc.

70 Normal Compression Springs have outside diameters about eight times size of wire and space between coils about twice size of wire. Therefore to determine number of active coils for a spring of this class, divide free length of spring by three times "size of wire," to which two coils should be added for "squaring" if end coils are to be closed. Springs thus designed are ordinarily adapted to 60% compression. If complete compression is required, that fact should be stated.

71 "Safe Load" is the approximate number of pounds that a spring will carry safely and continuously under exacting conditions. This is about one-half the ultimate load that normal compression springs will carry when taxed to their limit by complete compression.

72 "Deflection per coil" multiplied by the number of coils in the spring under consideration will give approximately the distance that the spring will compress under the indicated safe load.

73 The load that a spring will carry increases uniformly per inch deflection, until the elastic limit of the metal is reached. A rather common misapprehension prevails to the effect that the tension increases at a greater rate per inch as the deflection progresses. For example, a spring carrying ten pounds when deflected one inch will carry about twenty pounds when deflected two inches and about thirty pounds when deflected three inches, if the spring is safely designed for three inches deflection.

74 Carrying capacity per inch of deflection is increased as the amount or developed length of the wire in a spring of given dimensions is decreased, length of spring remaining unchanged. Developed length of wire may be decreased by reducing the diameter of the spring without changing its length or number of coils; or by reducing the number of coils without changing the diameter or length, thereby increasing pitch. It will be seen from the table on opposite page that this stiffness of the spring by reason of reducing the amount of wire it contains reduces the distance per coil that the spring can be safely deflected.

75 Occasionally insufficient working space is allowed for springs, thereby preventing the use of as much wire or as heavy wire as the spring should contain. (As stated in paragraph 85, "Springs with higher than normal pitch are not safe for hard work, as they are likely to take a permanent set if made with regular temper, or are liable to break if given a high temper to enable them to return to original position.")

Neither special wire nor special temper can make a spring safe if its diameter is less than it should be for required load.

See page 7 for statement of variation allowances or tolerances that should be granted.

Compression Springs

(OPEN WOUND)

Phosphor Bronze Springs for stop cocks, etc., a specialty.

Orders should state:

QUANTITY.

KIND OF WIRE—Steel, Brass or Phosphor Bronze.
(See explanations of usage page 3.)

SIZE OF WIRE—Express decimally or state gauge used, if specified by number. If spring is to carry a specified load, see paragraph 95.

DIAMETER OF SPRING.

75 State whether inside, outside or pitch diameter measurement. The pitch diameter is the distance from center to center of wires, measured across center of end of spring.

77 If spring works over a rod or in a hole, please state size of the rod or hole. It is usually customary to specify inner diameters when springs are to work over rods, and outer diameters if same are to work in holes, or in the clear.

79 Care should be taken to allow ample clearance or working space between springs and adjacent parts so that spring can work freely. In this connection see page 7 regarding necessary variation allowances.

81 To secure desired capacities springs of a given size of wire are made of various diameters; as the diameter of the spring decreases its carrying capacity rapidly increases and its traveling range is correspondingly decreased.

LENGTH—Give free length if a design order. If length under load is ordered, see paragraphs 95 and 97.

PITCH—"Lead" or spacing of coils. (See cut.)

85 Springs with higher than normal pitch are not safe for hard work as they are liable to take a permanent set (not returning to original position) if made with regular temper. Or are liable to break if given a high temper to enable them to return to original position.

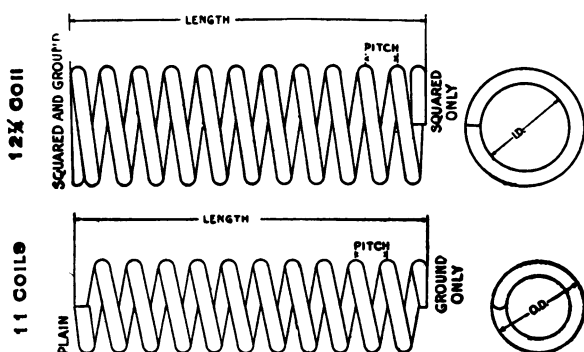
NUMBER OF COILS.

87 As the number of coils per inch determines pitch this item is closely related to paragraph 85. Decreasing the number of coils without changing other details increases the carrying capacity of a spring but correspondingly reduces its safe traveling capacity. **Distance that a spring is to be compressed and under what load** should be given when buyer cannot specify number of coils per inch or pitch.

If end coils are closed ("squared") the number of active coils will be two less than the total number of coils.

See printed outlines, page 2, for describing springs.

89 *A somewhat common error in ordering springs is to sketch a spring with open ends (all coils active) and to provide by footnote that ends are to be "squared and ground." In such cases it is impossible to follow both sketch and footnote. Squared ends should not be ordered unless there is sufficient space to take care of the necessary two non-active end coils, in addition to the required number of active coils. If the two coils required for closing the ends are taken from the number of coils sketched as active, the result is likely to be an abnormally high pitch (see paragraph 85) and not enough active coils to safely do the work.*



91 We make springs with either right or left hand coils and customers should state which direction of coil is wanted if they have any choice in the matter.

93 Our regular prices on springs with ground ends cover ordinary grinding only. If it is required that ends be perfectly square and absolutely at right angles to the body of the spring at all points, an extra charge will be made to cover the required extra labor.

FINISHES—Plain, rumbled bright, japanned (black) and temper colors.

95 If springs are ordered to carry a given number of pounds at a stated length, the determination of the size of wire to be used, number of coils and free length, should be left to the springmaker, subject to such limitations as may be necessary. The space available for the spring when under its maximum compression should be stated, as spring must be so designed that it will not "go solid" before the limit is reached.

97 When all dimensions are prescribed by the buyer we cannot then assume responsibility for the springs carrying the desired load. On the other hand, if a spring has been fully tried out and found to be satisfactory, it is a good plan to furnish the springmaker with a sample or description of same.

Variation allowances should be made as explained on page 7.

See inquiry and order form, page 2.

Extension or "Pull" Springs

(CLOSE WOUND)

Suggestions concerning descriptions.

Inquiries and orders, not accompanied by samples or complete sketches, should state:

QUANTITY.

SIZE AND KIND OF WIRE. (See explanations, pages 3 and 6.)

DIAMETER OF SPRING.

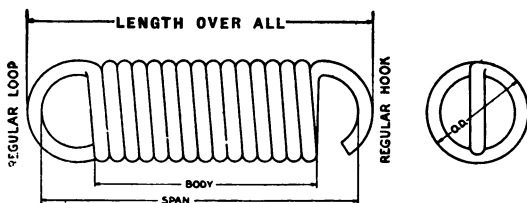
103 Stated diameters of extension springs will be understood to indicate outside diameters, unless otherwise indicated.

105 When extension springs are to be deflected 50% of their length, it is generally considered that outer diameter should be about eight times size of the wire from which springs are made.

107 Extension springs of small diameters have more tension than those of larger diameters, made from the same size of wire, but the distance that the springs of small diameter can be extended is proportionately reduced. Therefore, springs that are to be subjected to a long pull should have coils of ample diameter. The required tensile strength should be obtained by using sufficiently heavy wire, rather than by using light wire and reducing the diameter of the spring.

LENGTH.

If spring is wanted to carry stated load see paragraph No. 119.



HOOKS OR LOOPS? (See preceding sketch)

When practicable, send blue print or sample of assembly in which springs are used. If this is not done, state space limitations and working range of springs.

111 Hooks or loops will be placed across center of end of spring, as shown in preceding cut, unless ordered "turned on side," as shown below.



113 If it is required that the hooks or loops on the two ends of a spring be turned in the same plane, indicate by stating that they are to be "in line." If, on the other hand, it is desired that they stand at right angles to each other, that fact should be stated.

115 If terminals other than regular hooks or loops are required, sample or complete sketch should be furnished.

119 If a spring is wanted that will carry a given load when extended to a specified length, the determination of the free length and size of wire is usually left to the springmaker. State diameter of spring, load (in pounds), and length of spring when extended under load.

121 The length under load is usually measured inside of the loops, which is the measurement indicated as "span" in the outline cut.

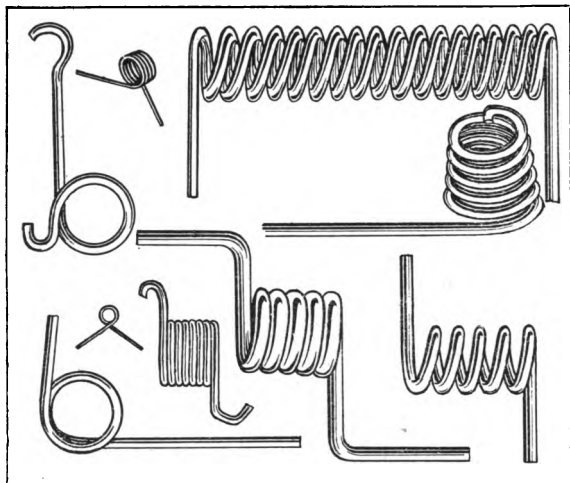
Orders should indicate whether stated lengths are "free," or "under load," and also whether the measurement is "body," "span," "center to center of hooks," or "over-all."

When practicable, send blue print or sample of assembly in which springs are used. If this is not done, state space limitations and working range of springs.

Inquiry and order blank on page 2.

Torsion Springs

Send samples or complete drawings of springs desired, stating work that they are to do (load, movement or distance traveled, etc.)



SPRING TUBING

Armor for
Control Wires, etc.



Coppered, Plain
or Black Rust Proof Finish

Prices
Upon Application.

SPRING BELTS

Coupled with inserted short springs



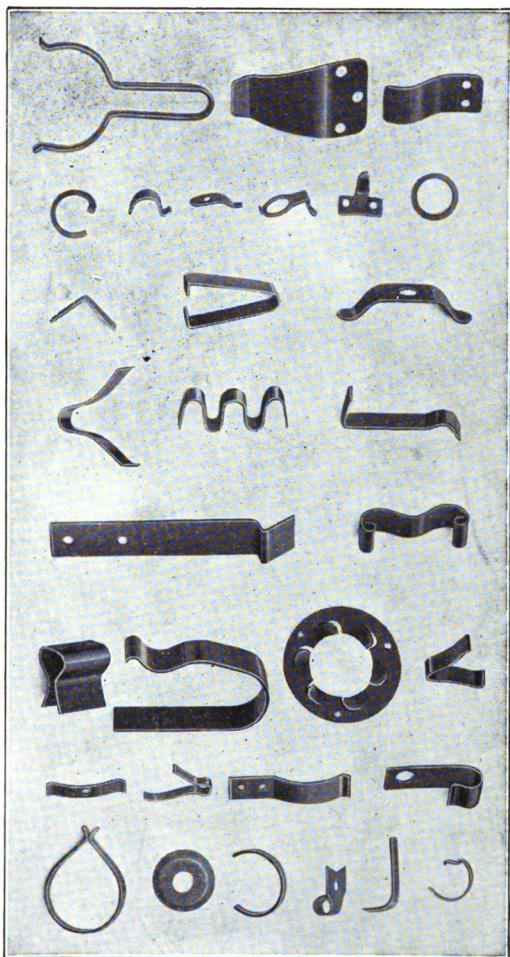
Flat Springs

The following cuts show a few of the designs we have made. Flat springs are made to order only (not carried in stock) and the fact that expensive special tools are required usually prevents our accepting orders for small quantities.

Terms for special tools, cash deposit with order. **Tools not subject to removal.**

Submit samples or complete sketch. See page 7 for statement of tolerances or variation allowances.

Flat springs are usually made from steel and rumbled bright. We can make from other materials than steel when quantities warrant obtaining special materials.



When practicable, send blue print or cample of assembly in which springs are used. If this is not done, state space limitations and working range of springs.

Weights, page 32.

Bent Wires

Prices quoted upon application. Send sample or complete detailed description and state quantity under consideration.

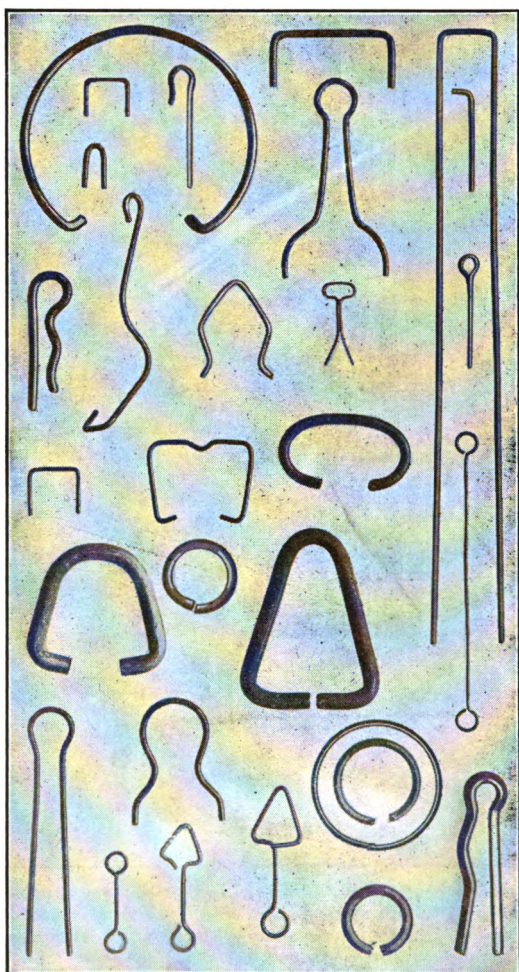
These are usually made from steel, oil-tempered, not japanned.

However, we are not limited to steel, but can make from any suitable metal that may be desired. Under this heading Brass Rings are occasionally called for.

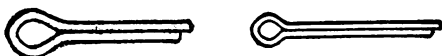
See page 7 for statement of tolerances or variation allowances.

Special tools not subject to removal.

Submit sample or blue print of assembly when possible to do so.



Spring Cotters



MEASURE UNDER HEAD

The closed special points permit of the cotters being inserted in holes as quickly as nails or single wires can be inserted.

We make our cotters with one leg slightly shorter than the other, which greatly facilitates insertion of spreading tool.

These features save enough time in assembling to more than pay for the cotters used.

PRICE LIST OF STEEL COTTERS (IN BULK)

Brass Cotter list, eight times steel list.
Prices per 1,000, subject to discount.

Wire Gauge	16	13	11	9	7	4
Diameter	1-16	3-32	1-8	5-32	3-16	1-4
Length Inches	1-2	\$.33	\$.33	\$.45	\$	\$
3-4	.43	.43	.58	.93	1.25	
1	.53	.53	.70	1.10	1.55	2.80
1 1-4	.63	.63	.83	1.28	1.85	3.20
1 1-2	.73	.73	.95	1.45	2.15	3.60
1 3-4	.83	.83	1.08	1.63	2.45	4.00
2		.93	1.20	1.80	2.75	4.40
2 1-4			1.55	2.00	3.05	4.80
1-2			1.55	2.20	3.35	5.20

Measure lengths under heads. Intermediate lengths take price of next longer listed length.

We carry leading sizes of Brass and Steel Cotters in stock (in bulk).

On account of our minimum charge of 50 cts. per item and the fact that we ship cotters in bulk only, minimum quantity of each size ordered should be 2000, and on account of small amount of revenue involved, we regard it to the interest of both buyer and seller that 10,000 or more of a size per delivery be taken, when consistent.

Cotter assortments page 35.

APPROXIMATE WEIGHTS PER THOUSAND

	Lbs.		Lbs.		Lbs.
1/16x½	.45	1/8x½	2.70	3/16x1	9.70
½	.58	¾	8.25	1¼	11.40
¾	.65	1	8.80	1½	18.05
1	.74	1½	4.12	1¾	14.70
1	.95	1¾	4.60	2	16.40
		1¾	5.00	2¼	18.05
3/32x½	1.40	1½	5.80	2½	19.70
¾	1.65	1¾	6.60		
1	1.85	2	7.40	1/4x1¼	19.60
1	2.06	2¼	8.20	1½	22.55
1 1/4	2.30	2½	9.00	1¾	25.50
1 1/2	2.69			2	28.45
		5/32x1	6.60	2¼	31.40
		1¼	7.80	2½	34.50
		1½	8.90		
		1¾	10.10		
		2	11.80		

Washers and Discs

Most of our production is from Brass, Cold Rolled Steel, Aluminum and Paper, about 1/32" thick but when quantity warrants we are prepared to make from other materials, any desired thickness up to 3/16" in sizes not larger than 2½" O. D.

We are adding new sizes from time to time as occasion requires. New lists are issued at frequent intervals covering all sizes for which tools have been made up to time of issuing of list. A copy of latest list will be mailed with this catalog, and later lists will be furnished upon application.

We carry leading sizes in stock.

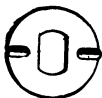
SPECIAL WASHERS

For stove and stop cock manufacturers and others we make a number of special designs such as square, cupped, corrugated and bowed washers from brass, mild cold rolled steel and oil tempered spring steel.

Orders and enquiries for special washers and stampings are solicited. Send us blue prints or samples. Both current and annual requirements should be specified.

"DD" LOCK WASHERS

Oblong holes for flattened stems.



Ribbed Designs

17/64"	—	3/16"	X	7/16"
17/64"	—	3/16"	X	31/64"
17/64"	—	3/16"	X	9/16"
11/32"	—	1/4"	X	11/16"
3/8"	—	1/4"	X	11/16"
3/8"	—	1/4"	X	3/4"
3/8"	—	1/4"	X	27/32"
23/64"	—	15/64"	X	27/32"

Plain Surface
(Not Ribbed)

3/8"	—	1/4"	X	9/16"
------	---	------	---	-------

"D" WASHERS

(Not Milled)



(Hole)		(Diam.)
19/64"	—	17/64" X 7/16"
.328"	—	.290" X 1/2"
.334"	—	.290" X 9/16"
11/32"	—	5/16" X 11/16"

U. G. I. BRASS WASHERS

Also plain and coppered cold rolled steel.

1/2"	X	7/32"
9/16"	X	11/32"
9/16"	X	23/64"

CORRUGATED ALUMINUM WASHERS

For use under heads of stove bolts to protect enameled surfaces and improve appearance.

9/16"	X	3/16"
9/16"	X	1/4"
3/4"	X	.220"

Other sizes to order, quantity warranting.

PAPER WASHERS

For use on ends of stopcock handles to prevent porcelain from breaking.

Present stock sizes:

3/8"	X	7/32"
27/64"	X	13/64"
7/16"	X	3/16"

Any sizes shown in list of plain washers contained in folder can be furnished at favorable prices. Sizes for which we have no tools can be furnished under special arrangements when quantity warrants.

N. C. G. A. TAIL NUTS

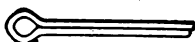
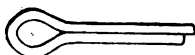
Brass and Steel
17/32", 7/64" thick
1/2", 5/64" thick
Tapped 5/16"—18 U. S. S. Thread

M. D. HUBBARD SPRING CO.

PONTIAC, MICHIGAN



Coiled and Flat Springs
Spring Cotters
Washers
Special Wire Shapes
and Metal Stampings



WELCH PATENT EXPANSION PLUGS

For Closing Core Holes



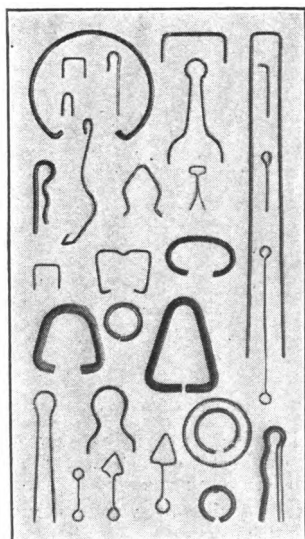
LIST OF WASHER SIZES

Inside diameters listed progressively

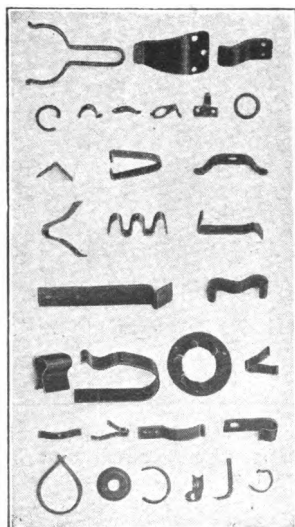
At present we have dies for sizes herein listed and are prepared to make other sizes, quantity warranting. Brass, steel and other materials. (See fourth page.)



BENT WIRES



FLAT SPRINGS



PLAIN FLAT WASHERS

(Specials, fourth page)

Arranged progressively in order of Inside Diameters

December, 1924.

.060" X .150"	.206" X 5/16"	.257" X 13/32"
1/8" X 5/16"	13/64" X 13/32"	.260" X .410"
.135" X 23/64"	13/64" X 27/64"	
.140" X .222"	13/64" X 1/2"	
9/64" X 7/32"	13/64" X 1"	
.142" X 5/16"	With arrow.	
	13/64" X 1-1/4"	17/64" X 3/8"
		17/64" X 7/16"
		17/64" X 29/64"
		17/64" X 15/32"
	7/32" X 5/16"	17/64" X 1/2"
	7/32" X 3/8"	17/64" X 9/16"
5/32" X 25/64"	7/32" X 7/16"	17/64" X 11/16"
5/32" X 1/2"	7/32" X 1/2"	17/64" X 7/8"
	7/32" X 39/64"	17/64" X 31/32"
	7/32" X 5/8"	
11/64" X 1/4"	7/32" X 27/32"	
.177" X .285"	.220" X 3/4"	
(11/64" X 9/82")	Corrugated	9/32" X 3/8"
		9/32" X 7/16"
		9/32" X 1/2"
3/16" X 17/64"	1/4" X 5/16"	9/32" X 5/8"
3/16" X 9/32"	1/4" X 3/8"	9/32" X 3/4"
3/16" X 3/8"	1/4" X 13/32"	
3/16" X 13/32"	1/4" X 27/64"	
3/16" X 7/16"	1/4" X 29/64"	
3/16" X 9/16"	1/4" X 1/2"	19/64" X 11/16"
Corrugated.	1/4" X 17/32"	19/64" X 3/4"
	1/4" X 9/16"	
.196" X .271"	1/4" X 9/16"	
.196" X 7/16"	Corrugated.	
.195" X 9/16"	1/4" X 5/8"	5/16" X 7/16"
	1/4" X 1 7/16"	5/16" X 1/2"

We make a number of special designs such as square, cupped, corrugated and bowed washers from brass, mild cold rolled steel and spring steel oil tempered.

Orders and inquiries for these styles of washers and other special stampings are solicited.

Blueprints and samples are desired.

Present and annual requirements should be specified.

PLAIN FLAT WASHERS, Continued

(Specials, fourth page,)

21/64" X 31/64"	27/64" X 21/32"	17/32" X 1 1/32"
21/64" X 1/2"	27/64" X 53/64"	17/32" X 1 17/32"
21/64" X 9/16"		
21/64" X 5/8"		
21/64" X 3/4"		35/64" X 43/64"
21/64" X 7/8"		
	7/16" X 37/64"	9/16" X 23/32"
	7/16" X 5/8"	9/16" X 13/16"
	7/16" X 3/4"	9/16" X 27/32"
11/32" X 31/64"	7/16" X 27/32"	9/16" X 29/32"
11/32" X 9/16"	7/16" X 29/32"	
11/32" X 11/16"	7/16" X 15/16"	
11/32" X 3/4"	7/16" X 31/32"	19/32" X 29/32"
11/32" X 49/64"	7/16" X 1"	19/32" X 1 7/64"
	7/16" X 1 1/16"	
		5/8" X 1"
23/64" X 9/16"		21/32" X 53/64"
	29/64" X 37/64"	21/32" X 27/32"
	29/64" X 59/64"	21/32" X 1 1/4"
3/8" X 5/8"		11/16" X 29/32"
3/8" X 43/64"		11/16" X 15/16"
	15/32" X 13/16"	23/32" X 7/8"
	15/32" X 31/32"	
25/64" X 11/16"	15/32" X 1 1/8"	49/64" X 29/32"
25/64" X 49/64"		
25/64" X 61/64"		25/32" X 1 1/8"
		25/32" X 1-3/16"
	1/2" X 1 1/4"	25/32" X 1 1/4"
13/32" X 35/64"	1/2" X 1 3/8"	
13/32" X 5/8"		13/16" X 1 3/32"
13/32" X 21/32"		13/16" X 1-5/32"
13/32" X 23/32"		13/16" X 1 3/8"
13/32" X 51/64"		
13/32" X 13/16"	33/64" X 45/64"	
13/32" X 7/8"	33/64" X 13/16"	1 17/32" X 2 3/8"

Cuts of "D" and "DD" Washers and dimensions of holes will be found in special list on next page.

WASHERS AND DISCS

Most of our production is from Brass, Cold Rolled Steel, Aluminum and Paper, about $1/32$ " thick but when quantity warrants we are prepared to make from other materials, any desired thickness up to $3/16$ " in sizes not larger than $2\frac{1}{2}$ " O. D.

We are adding new sizes from time to time as occasion requires. New lists are issued at frequent intervals covering all sizes for which tools have been made up to time of issuing of list.

We carry leading sizes in stock.

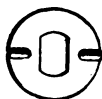
SPECIAL WASHERS

For stove and stop cock manufacturers and others we make a number of special designs such as square, cupped, corrugated and bowed washers from brass, mild cold rolled steel and oil tempered spring steel.

Orders and enquiries for special washers and stampings are solicited. Send us blue prints or samples. Both current and annual requirements should be specified.

'DD' LOCK WASHERS

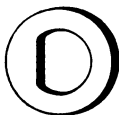
Oblong holes for flattened stems.



Ribbed Designs

17/64"	—	3/16"	X	7/16"
17/64"	—	3/16"	X	31/64"
17/64"	—	1/16"	X	9/16"
11/32"	—	1/4"	X	11/16"
23/64"	—	15/64"	X	27/32"
23/64"	—	1/4"	X	39/64"
3/8"	—	1/4"	X	11/16"
3/8"	—	1/4"	X	3/4"
3/8"	—	1/4"	X	27/32"
Plain Surface (Not Ribbed)				
3/8"	—	1/4"	X	9/16"

"D" WASHERS (Not Milled)



(Hole)		(Diam.)
1/4"	—	.240 X 7/16"
19/64"	—	17/64" X 7/16"
.328"	—	.290" X 1/2"
.334"	—	.290" X 9/16"
1/32"	—	17/64" X 1/2"
11/32"	—	5/16" X 11/16"

U. G. I. WASHERS

1/2"	X	7/32"
9/16"	X	11/32"
9/16"	X	23/64"

CORRUGATED ALUMINUM WASHERS

For use under heads of stove bolts to protect enameled surfaces and improve appearance.

9/16"	X	3/16"
9/16"	X	1/4"
3/4"	X	.220"

Other sizes to order, quantity warranting.

PAPER WASHERS

For use on ends of stopcock handles to prevent porcelain from breaking.

Present stock sizes:

3/8"	X	7/32"
27/64"	X	13/64"
7/16"	X	3/16"

Any sizes shown in list of plain washers can be furnished at favorable prices. Sizes for which we have no tools can be furnished under special arrangements when quantity warrants.

N. C. G. A. TAIL NUTS

17/32", 7/64"	thick
1/2", 5/64"	thick
Tapped 5/16" - 18	U. S. S. Thread

WELCH PATENT EXPANSION PLUGS

for closing core holes.

Patented April 8, 1913



PLUG READY TO EXPAND

STANDARD MATERIAL, HOT ROLLED STEEL.

WE make Brass Plugs for marine work where a material that will resist the corrosive action of salt water is required.

Aluminum Plugs are made for use in aluminum castings or when extra lightness is desired.

Plugs made from bronze or other special material made to order when quantity warrants.

Prices upon application.

We aim to carry the leading sizes of Steel Plugs in stock. For list of sizes see following page.

USED FOR

Closing core holes in motor cylinders (Auto, Stationary, and Marine).

Closing bearings at ends of jack and cam shafts.

Closing holes in intake manifolds.

Closing holes in crank shaft cases.

Closing holes in auto crank shafts (when drilled for oil circulation).

Closing holes in steering gear cases.

Closing holes in motor governor balls.

Closing holes in carburetors and oil gauges.

Closing ends of spring bolts.

Closing holes in ends of wrist pins.

Closing any and all openings that are to be closed permanently by a tapered, cupped, or threaded plug.

ADVANTAGES

Can be inserted in one-tenth the time required for pipe plugs.

No castings spoiled in threading.

No imperfect or leaky threads.

Are much more sightly than pipe plugs.

Can be made invisible by finishing flush, as in stopping sand holes, etc.

Lighter lugs can be used than with taper plugs, as lateral or bursting strains are much lower.

Can be put in so cheaply as to allow of their being used for test purposes in the Foundry.

When properly placed will resist pressure of two hundred to three hundred pounds.

Welch Patent Expansion Plugs

PRICE LIST (STEEL) JUNE, 1923

We have dies for making following sizes. Quantity warranting, we will make tools for such other sizes required by customers as may be practicable.

Minimum charge per item, 50 cents.

Diameter	Price Per M	Approximate Weights per 1000*	
		Steel Gauge	Pounds
1/8"	\$ 2.00	.025"	.08
3/16"	2.20	.025	.17
1/4"	2.40	.032	.44
5/16"	2.60	.065	1.3
3/8"	2.80	.065	1.9
7/16"	3.00	.065	2.6
1/2"	3.20	.065	3.3
9/16"	3.35	.065	4.2
5/8"	3.45	.065	5.2
11/16"	3.65	.065	6.3
3/4"	4.00	.065	7.5
13/16"	4.95	.065	9.
7/8"	5.40	.083	13.
15/16"	5.90	.083	15.
1"	6.45	.083	17.
1 1/16"	7.00	.083	19.5
1 1/8"	7.65	.083	22.
1 3/16"	7.90	.083	24.5
1 1/4"	9.05	.083	27.
1 5/16"	9.75	.083	30.
1 3/8"	10.50	.083	33.
1 7/16"	11.90	.083	36.
1 1/2"	12.10	.083	39.
1 9/16"	13.25	.083	42.
1 5/8"	13.90	.083	45.5
1 11/16"	15.00	.083	49.
1 3/4"	15.80	.083	53.
1 13/16"	17.50	.083	57.
1 7/8"	17.85	.083	61.
1 15/16"	19.50	.083	65.
2"	20.05	.083	69.
2 1/16"	21.15	.083	73.
2 1/8"	22.30	.083	78.
2 1/4"	24.70	.083	88.
2 1/2"	29.40	.083	108.
2 9/16"	32.50	.083	113.
2 5/8"	34.00	.083	119.
2 11/16"	35.00	.083	125.
2 3/4"	36.00	.083	131.
3 3/16"	46.25	.134	303.
3 1/2"	55.00	.134	366.
3 3/4"	64.50	.134	420.

*Brass plugs weigh about 7% more than steel.

Aluminum plugs weigh about 34% of steel plugs weight.

Prices on aluminum and brass plugs will be quoted upon application and are subject to change as the market price of these materials varies from time to time.

Prices on special diameter plugs shown in dimension table on next page, also special gauge and special radius plugs, will be quoted upon receipt of specifications, (quantity warranting).

Welch Patent Expansion Plugs

Diameters, Gauges and Approximate Radii

Size Inches	Diameter		1 Usual Gauge Inches	2 Optional Gauge Inches	5 Radius Inches
	Max. Inches	Min. Inches			
1/8"	.127	.123	.025	.082	11/64
3/16	.189	.186	.025	.082	13/64
1/4	.252	.248	.032	.025	15/64
5/16	.315	.310	.065	.....	17/64
3/8	.377	.372	.065	.....	13/32
.384					
7/16	.440	.435	.065	.....	15/32
1/2	.502	.497	.065	.049	17/32
.515					
9/16	.565	.560	.065	.....	11/16
5/8	.628	.622	.065	.....	13/16
11/16	.690	.684	.065	.....	7/8
3/4	.753	.747	.065	.....	15/16
13/16	.815	.809	.065	.083	1 1/32
7/8	.878	.872	.083	.065	1 3/32
15/16	.940	.934	.083	.....	1 5/32
1	1.003	.997	.083	.....	1 3/16
1 1/16	1.065	1.059	.083	.....	1 1/4
1 1/8	1.128	1.122	.083	.....	1 1/2
1 3/16	1.190	1.184	.083	.....	1 3/4
1 1/4	1.253	1.247	.083	.....	2
1 5/16	1.317	1.307	.083	.....	2
1 3/8	1.380	1.370	.083	.065	2
1 7/16	1.442	1.432	.083	.....	2 1/8
1 1/2	1.505	1.495	.083	.065	2 1/8
1 9/16	1.568	1.558	.083	.....	2 1/4
1 5/8	1.630	1.620	.083	.....	2 3/8
1 11/16	1.693	1.683	.083	.....	2 1/2
1 3/4	1.755	1.745	.083	.....	2 3/4
1 13/16	1.817	1.807	.083	.....	3
1 7/8	1.880	1.870	.083	.....	3
1 15/16	1.942	1.932	.083	.....	3 3/32
2	2.005	1.995	.083	.....	3 3/16
2 1/16	2.067	2.057	.083	.....	3 3/16
2 1/8	2.130	2.120	.083	.....	3 1/4
2 1/4	2.255	2.245	.083	.....	3 9/16
2 1/2	2.505	2.495	.083	.....	4 5/32
2 9/16	2.568	2.558	.083	.....	4 5/32
2 5/8	2.630	2.620	.083	.....	4 1/4
2 11/16	2.692	2.682	.083	.....	4 1/4
2 3/4	2.755	2.745	.083	.....	4 1/2
3 3/16	3.192	3.182	.134	.....	5 1/2
3 1/2	3.505	3.495	.134	.....	6
3 3/4	3.755	3.745	.134	.....	6 5/8

1. The gauges shown as "usual," are considered as standard for ordinary work and we aim to carry steel plugs of these gauges in stock at all times.

2. The lighter gauges shown as "optional" have been used in light castings by some of our customers. Occasionally we have these gauges in stock, but not always.

3. Occasionally heavier plugs than those we show are required, but these will only be made when quantity warrants and the need has been demonstrated by experience.

4. In determining gauges it has been the aim to make plugs amply heavy for safety. Plugs that are too thick are likely to cause breakage of castings.

5. For certain work where the pressure applied to the plug is unusually severe, we make special radius plugs from steel thicker than that used for standard plugs. For example, 5/8" x .083" steel plugs 15/32 radius. By this means, the expansive force and gripping power of the plug is greatly increased.

6. By undercutting counterbored hole as per assembly illustration No. 10 on following page, the ability of the plug to resist internal pressure is still further increased.

ILLUSTRATIONS

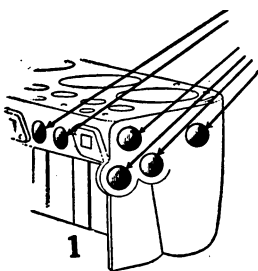
A few of the many ways in which the
Welch Patent Expansion Plugs
 can be advantageously used.



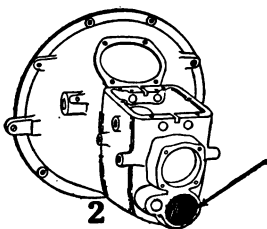
PLUG READY TO EXPAND



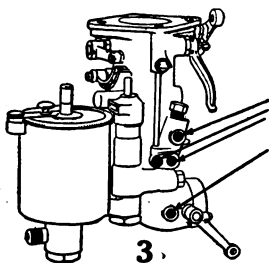
PLUG WITH DRAWN
HOLE FOR TAPPING



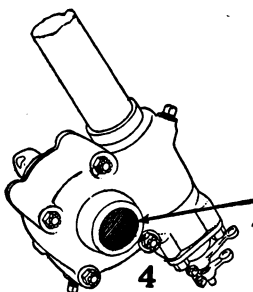
CYLINDER CASTINGS



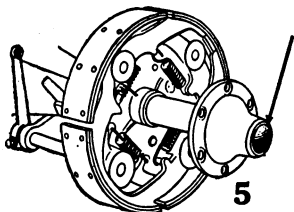
TRANSMISSION



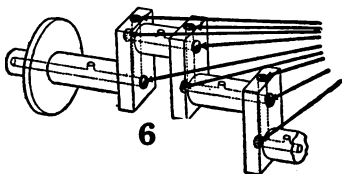
CARBURETOR



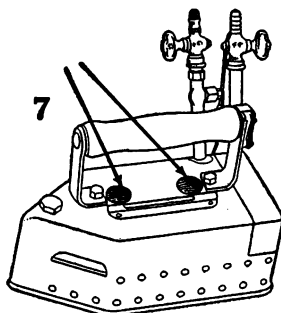
STEERING GEAR



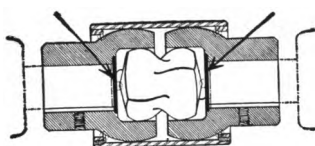
AXLE



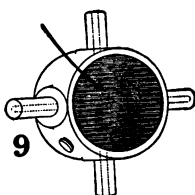
CRANK SHAFT



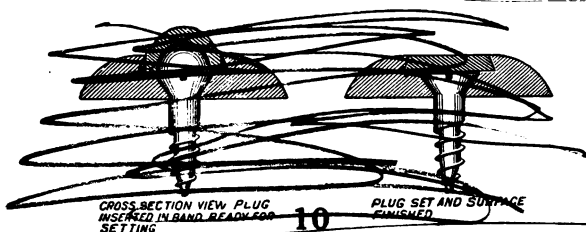
GAS IRON



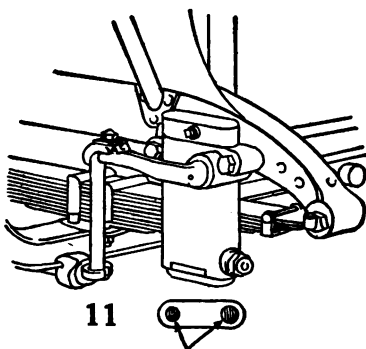
8 UNIVERSAL JOINT
(Grease Retainers)



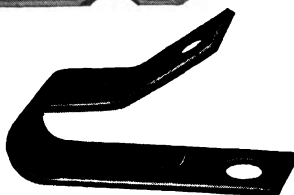
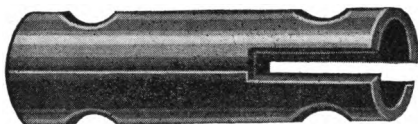
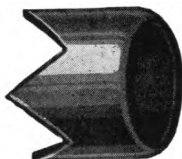
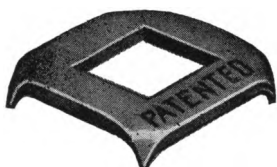
CROSS FOR UNIVERSAL
JOINT
(counterbored hole undercut)



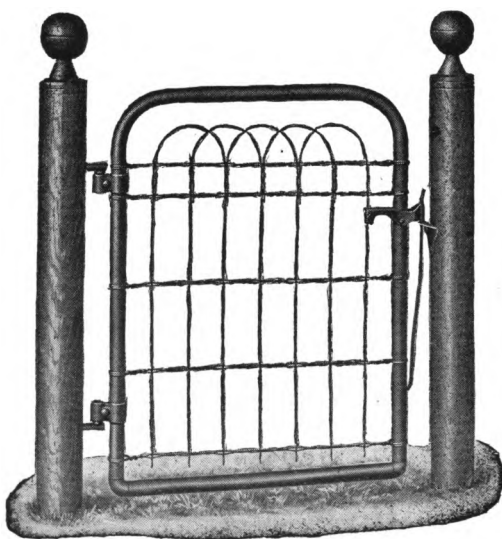
AUTOMOBILE BODY MOLDING
SCREW HEAD COVERS



SHOCK ABSORBER

SPECIAL STAMPINGS**To Order.**

**ALL-STEEL
NON-BREAKABLE GATE
FITTINGS
(Patented)**



ALL-STEEL
NON-BREAKABLE GATE HINGE
(Patented)



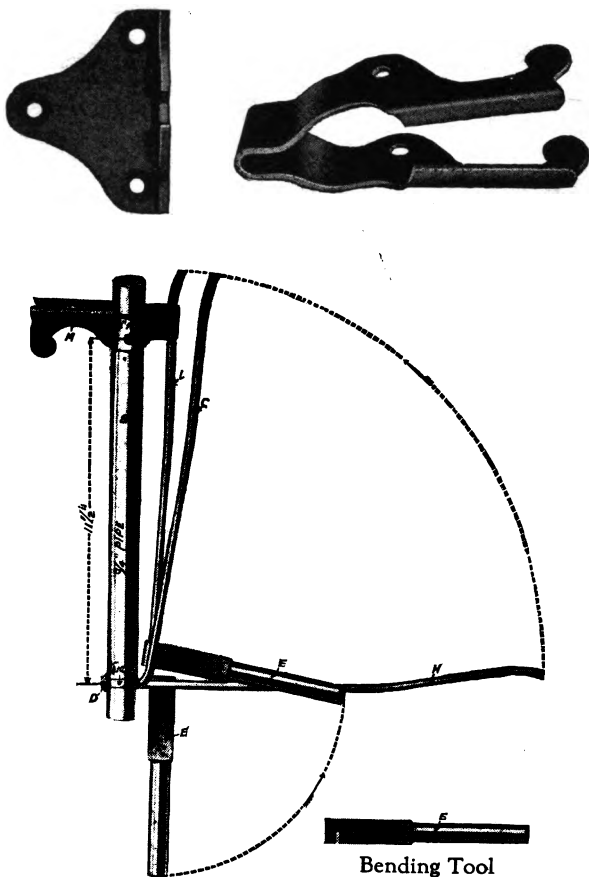
Takes Fewer Bolts

A Steel Stamping that will withstand the hardest usage; is more easily and quickly attached; no filing, grinding, or drilling necessary before attaching to the Gate Frame; makes a neater and better looking Gate in every way, and lowers the cost of production.

Furnished for $\frac{3}{4}$ and 1-inch pipe.

ALL-STEEL NON-BREAKABLE GATE LATCH

(Patented)



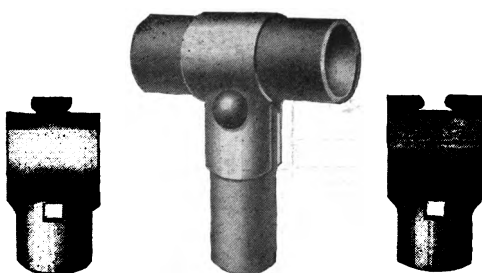
Pipe drilled with two $17/64$ " holes $11\frac{1}{2}$ " center to center, for latch bolt and latch rod.

Latch rod and bending tool shown in three positions.

Simplest and strongest Latch made.

Easily and quickly attached to Gate, which is done after the wire is in, and before the Gate is removed from the Filling Table or Bench, which saves handling.

ALL-STEEL
NON-BREAKABLE GATE CLAMPS
(Patented)



Wire Gate and Fence manufacturers are using all-steel non-breakable hinges, latches and clamps more and more, not only because they are cheaper, but because they are stronger, truer to form, and save time in assembling.

Consider what you save in freight on account of their lightness, compared with malleables.

We can furnish above clamps $\frac{3}{4}$ " and 1".

Comparison of Wire Gauges

By decimal equivalents progressively arranged

See following pages for comparison by numbers, etc.

Decimal Size*	Common Fraction	Washburn & Moen	Birm'gh'm Wire Gauge (Stubs)	U. S. Standard	Brown & Sharpe	Music Wire
.015		29				
.0156	1/64"			28		
.016		28	27		26	6
.017		27		27		
.018		26	26		25	7
.019				26		
.020		25	25		24	8
.022			24	25		9
.0225					23	
.023		24				
.024						10
.025			23	24	22	
.026		23				11
.028		22*	22	23	21*	12
.030						13
.0312	1/32"			22		
.032		21	21		20	14
.034				21		15
.035		20	20			
.036					19	16
.038				20		17
.03937	1 Millimeter					
.040					18	18
.041		19				
.042			19*			19
.044				19		20
.045					17	
.046						21
.0469	3/64"					
.047		18*				
.048						22
.049			18			
.050				18		
.051					16	23
.054		17				

*Decimal equivalents are approximate.

For exact equivalents, weights, additional sizes, etc., see Page 31 and following pages.

DECIMAL EQUIVALENTS TABLE—Continued

Decimal Size	Common Fraction	Washburn & Moen	Birm'gh'm Wire Gauge (Stubs)	U. S. Standard	Brown & Sharpe	Music Wire
.055						24
.056				17		
.057					15	
.058			17			
.059						25
.0625	1/16"			16		
.063		16				26
.064					14	
.065			16			
.067						27
.070				15		
.071						28
.072		15	15		13	
.074						29
.078	5/64"			14		30
.080		14				
.081					12	
.083			14			
.091					11	
.0915		13				
.0937	3/32"			13		
.095			13			
.102					10	
.1055		12				
.109	7/64"		12	12		
.1144					9	
.120		11	11			
.125	1/8"			11		
.1285					8	
.134			10			
.135		10				
.1406	9/64"			10		
.144					7	
.148		9	9			
.1562	5/32"			9		
.162		8			6	
.165			8			
.172	11/64"			8		

For exact equivalents, weights, additional sizes, etc., see Page 31 and following pages.

DECIMAL EQUIVALENTS TABLE—Continued

Decimal Size	Common Fraction	Washburn & Moen	Birm'gh'm Wire Gauge (Stubs)	U. S. Standard	Brown & Sharpe	Music Wire
.177		7				
.180			7			
.182					5	
.188	3/16"			7		
.192		6				
.203	13/64"		6	6		
.204					4	
.207		5				
.219	7/32"			5		
.220			5			
.225		4				
.229					3	
.234	15/64"			4		
.238			4			
.244		3				
.250	1/4"			3		
.258					2	
.259			3			
.2625		2				
.266	17/64"			2		
.281	9/32"			1		
.283		1				
.284			2			
.289					1	
.2968	19/64"					
.300			1			
.307		0				
.313	5/16"			0		
.325					0	
.328	21/64"					
.331		00				
.340			0			
.344	11/32"			00		
.359	23/64"					
.362		000				
.365					00	
.375	3/8"			000		

For exact equivalents, weights, additional sizes, etc., see Page 31 and following pages.

BROWN AND SHARPE—"B. & S."**AMERICAN WIRE GAGE****(Not American Steel and Wire Co.'s Gage)**

Standard for Phosphor Bronze
and Brass Wires.

See also, page 3

Gage Number	Decimal Equivalent	Approximate Weight in Lbs. per 100 Linear Feet		
		Phosphor Bronze	Brass	Steel
0000	.4600	64.05	60.518	56.44
000	.40964	50.79	47.991	44.75
00	.3648	40.28	38.067	35.50
0	.32486	31.94	30.182	28.16
1	.2893	25.33	23.935	22.32
2	.25763	20.09	18.982	17.70
3	.22942	15.93	15.052	14.04
4	.20431	12.63	11.938	11.13
5	.18194	10.02	9.467	8.82
6	.16202	7.94	7.508	7.00
7	.14428	6.30	5.955	5.55
8	.12849	4.99	4.722	4.40
9	.11443	3.96	3.744	3.49
10	.10189	3.14	2.969	2.77
11	.09074	2.49	2.355	2.20
12	.08081	1.97	1.868	1.74
13	.07196	1.56	1.481	1.38
14	.06408	1.24	1.175	1.11
15	.05707	.986	.932	.870
16	.05082	.782	.759	.689
17	.04526	.620	.586	.547
18	.0403	.491	.4645	.433
19	.03589	.390	.3684	.344
20	.03196	.309	.292	.273
21	.02846	.245	.2317	.217
22	.02535	.194	.1838	.171
23	.02257	.154	.1457	.136
24	.0201	.122	.1155	.108
25	.0179	.0970	.0916	.0855
26	.01594	.0769	.0727	.0674
27	.01419	.0610	.0576	.0538
28	.01264	.0484	.0457	.0423
29	.011267	.0386	.0362	.0341
30	.01002	.0303	.0287	.0267
31	.00893	.0241	.0228	.0213
32	.00795	.0191	.0181	.0169
33	.00708	.0152	.0144	.0134
34	.0063	.0120	.0114	.0106
35	.00561	.0096	.0090	.0084
36	.005	.0076	.0072	.0067
37	.00445	.0060	.0057	.0053
38	.00396	.0048	.0045	.0042
39	.00353	.0038	.0036	.0034
40	.00314	.0030	.0028	.0026

Music Wire

See also, page 3

Gauge No.	A. S. & W. Decimal Equivalent	W. & M. Decimal Equivalent	Feet Per Pound (Approximate)
00-----	.008	-----	5,850.
00-----	-----	.0085	5,180.
0-----	.009	.009	4,625.
1-----	.010	.010	3,740.
2-----	.011	.011	3,090.
3-----	.012	.012	2,600.
4-----	.013	.013	2,215.
5-----	.014	.014	1,910.
6-----	.016	.016	1,460.
7-----	.018	.018	1,155.
8-----	.020	.020	935.
9-----	.022	.022	770.
10-----	.024	.024	650.
11-----	.026	.026	555.
12-----	-----	.028	475.
12-----	.029	-----	445.
13-----	-----	.030	415.
13-----	.031	-----	390.
14-----	-----	.032	365.
14-----	.033	-----	344.
15-----	-----	.034	322.
15-----	.035	-----	306.
16-----	-----	.036	288.
16-----	.037	-----	273.
17-----	-----	.038	260.
17-----	.039	-----	246.
18-----	-----	.040	234.
18-----	.041	-----	223.
19-----	-----	.042	212.
19-----	.043	-----	202.
20-----	-----	.044	193.
20-----	.045	-----	186.
21-----	-----	.046	177.
21-----	.047	-----	169.
22-----	-----	.048	162.
22-----	.049	-----	156.
23-----	.051	.051	144.
24-----	.055	.055	124.
25-----	.059	.059	107.7
26-----	.063	.063	94.
27-----	.067	.067	83.5
28-----	.071	.071	74.2
29-----	-----	.074	68.3
29-----	.075	-----	66.6
30-----	-----	.078	61.5
30-----	.080	-----	58.5

Music Wire, also termed "Piano Wire," is a bright surfaced, hard drawn steel wire of extra quality. For ordinary purposes Nos. 6 to 20 is about the range of spring sizes and we carry large stocks of these sizes.

SPRING AND COTTER ASSORTMENTS

SHIPPED IN SACKS

No. 16, Standard Assortment of Steel Springs.

Mostly Compression and Extension Designs, light, medium and heavy. About 125 different kinds or designs, several of each of the more common sizes. (Total about 300 Springs.)

16 lbs., \$2.00 net, by express at buyer's cost.

No. 3 Assortment, Small and Medium Springs.

Nothing larger or heavier than automobile valve springs.

3 lbs., \$1.25, net, postpaid.*

No. 1 Assortment.

One dozen 12" lengths open and close wound springs, coil $\frac{1}{4}$ " to $\frac{1}{2}$ " diameter, six sizes of wire.

75c postpaid.*

No. 7 Assortment.

Large, medium and small springs, one of each size on hand in quantity lots at the time of packing or assembling. Generally about 7 lbs.

\$1.50 postpaid.*

Special Pick-up Lots.

(Selections by buyers from samples or assortments received from us.) Auto valve spring sizes or lighter 10 lbs. or more 30 to 40 cts. per lb. Small lots, 1 ct. per spring, minimum sale or charge, 50 cts.

Heavier springs than preceding paragraph, 25c per pound, minimum charge \$1.00.

Alterations to Meet Requirements

Extension springs that are too long for required purpose may be cut with a cold chisel and re-looped.

Compression springs that are too long may be cut on an emery wheel and used with one end closed and one end open.

COTTER ASSORTMENTS

No. 25, Full Line Assortment.

For Agricultural Implement Dealers, Garages, General Machine Shops, etc.

Sizes $\frac{1}{16}$ in. to $\frac{1}{4}$ in. diameter. Lengths $\frac{1}{2}$ in. to $2\frac{1}{2}$ in. Mostly in the smaller diameters and lengths under 2 in. About 12,000 Cotters, suitably assorted.

25 lbs., \$3.50 net, by express at buyer's cost.

Light and Medium Sizes.

(Ford and General Auto Repairs, etc.)

No. 10 Assortment, $\frac{1}{16}$ to $\frac{3}{16}$ in.

Lengths $\frac{1}{2}$ in. to $1\frac{3}{4}$ in.

10 lbs., \$2.50 net, postpaid.*

Light Cotters (Ford Sizes, etc.)

No. 5 Assortment, $\frac{1}{16}$, $\frac{3}{32}$ and $\frac{1}{8}$ in.

Lengths $\frac{1}{2}$ in. to 1 in.

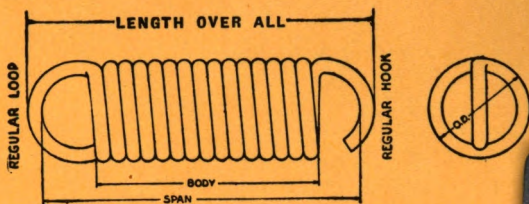
5 lbs., \$1.75 net, postpaid.*

* All parcel postage items at our cost, limited to U. S. points east of the Missouri River (five zones).

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Forms for Describing Springs



Regular Extension Springs

Quantity.....Size of Wire.....

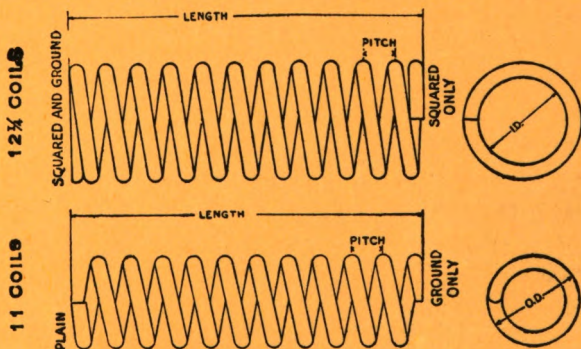
Outer Diameter.....

Length of Body.....
(If length is measured over all or span, state that)

Hooks or Loops.....

Japanned or Plain.....

Distance Extended.....Load in lbs.....



Regular Compression Springs

Quantity.....Size of Wire.....

Diameter.....Length.....
(State whether outer or inner dimensions.)

Number of Coils.....Japanned?.....

Ends—Place an "X" opposite one of the four ends
of above springs to indicate style of ends wanted.

Distance Compressed.....Load in lbs.....

If springs work over a rod, specify diameter of rod.
if they work in a hole, specify size of hole.

Name.....

Ad.....



3 9015 07145 7504

Decimal Equivalents

1/64	.015625	33/64	.5
1/32	.03125	17/32	.5
1 Millimeter	.03937	35/64	.5
3/64	.046875	9/16	.5
1/16	.0625	37/64	.5
5/64	.078125	19/32	.5
3/32	.09375	39/64	.5
7/64	.109375	5/8	.5
1/8	.125	41/64	.5
9/64	.140625	21/32	.5
5/32	.15625	43/64	.5
11/64	.171875	11/16	.5
3/16	.1875	45/64	.5
13/64	.203125	23/32	.5
7/32	.21875	47/64	.5
15/64	.234375	3/4	.5
1/4	.25	49/64	.5
17/64	.265625	25/32	.5
9/32	.28125	51/64	.5
19/64	.296875	13/16	.5
5/16	.3125	53/64	.5
21/64	.328125	27/32	.5
11/32	.34375	55/64	.5
23/64	.359375	7/8	.5
3/8	.375	57/64	.5
25/64	.390625	29/32	.5
13/32	.40625	59/64	.5
27/64	.421875	15/16	.5
7/16	.4375	61/64	.5
29/64	.453125	31/32	.5
15/32	.46875	63/64	.5
31/64	.484375	1	.5
1/2	.5		.5